Perovskite Properties

Perovskite material refers to a specific molecular structure, a cube-octahedral. Table 1 shows the characteristics of the perovskite structure ABX$_3$. In figure 2 the molecular structure is depicted in a three-dimensional drawing. The advantages of using perovskite for the active/photosensitive layer include but are not limited to broad light absorption spectrum, tunable band gaps, long charge carrier diffusion, and low cost of preparation technology. A scanning electron microscope and an EDS is to be used to examine microstructural and elemental properties. Furthermore, an atomic-force microscopy and energy-dispersive X-ray spectroscopy test for surface properties.

### Table 1: Perovskite Chemical Formula

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chemical Type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Organic cation</td>
<td>Methylammonium, Formamidinium</td>
</tr>
<tr>
<td>B</td>
<td>Divalent metal ion</td>
<td>Lead, Tin, Bismuth (III)</td>
</tr>
<tr>
<td>X</td>
<td>Halide ion</td>
<td>Iodine, Bromine, Chlorine</td>
</tr>
</tbody>
</table>

Figure 2: Perovskite Structure

**Figure 3: Electron and Hole Transfer**

**Figure 4: Perovskite Layer Structure**

### Conclusion

Pb-free perovskite solar cells are being researched in the Lyles College of Engineering at Fresno State. Currently the layered structure with scaffolding along with an overlay of perovskite, shown in figure 4a, is being researched using bismuth (III), due to the promising degradation resistance from the environmental factors. The effectiveness of each trial are being measured by average efficiency with standard deviation. The goal is to promote/further perovskite research as a low cost and environmentally benign solution.

### References